Agency for Healthcare Research and Quality
Advancing Excellence in Health Care

NATIONAL QUALITY MEASURES CLEARINGHOUSE

General

Title

Abdominal aortic aneurysm (AAA) repair mortality: percentage of in-hospital deaths per 1,000 discharges with AAA repair, ages 18 years and older.

Source(s)

AHRQ QI research version 5.0. Inpatient quality indicator 11 technical specifications: abdominal aortic aneurysm (AAA) repair mortality rate. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2015 Mar. 3 p.

National Quality Forum measure information: abdominal aortic aneurysm (AAA) repair mortality rate (IQI 11). Washington (DC): National Quality Forum (NQF); 2014 Apr 1. 13 p.

Measure Domain

Primary Measure Domain

Clinical Quality Measures: Outcome

Secondary Measure Domain

Does not apply to this measure

Brief Abstract

Description

This measure is used to assess the percentage of in-hospital deaths per 1,000 discharges with abdominal aortic aneurysm (AAA) repair, ages 18 years and older.

The indicator is stratified into four groups by 1) type of AAA repair (open vs. endovascular) and 2) AAA rupture status.

Cases are assigned to strata according to a hierarchy based on mortality, with cases being assigned to the stratum with the highest mortality for which the case qualifies. In the case of AAA Repair Mortality the current hierarchy is as follows:

Strata hierarchy (listed from highest mortality to lowest mortality):

Stratum A (Open repair of ruptured AAA)
Stratum C (Endovascular repair of ruptured AAA)
Stratum B (Open repair of unruptured AAA)
Stratum D (Endovascular repair of unruptured AAA)

This measure summary represents the overall rate. See also the "Basis for Disaggregation" field.

Rationale

Abdominal aortic aneurysm (AAA) repair is a relatively rare procedure that requires proficiency with the use of complex equipment; and technical errors may lead to clinically significant complications, such as arrhythmias, acute myocardial infarction, colonic ischemia, and death. Better processes of care may reduce mortality for AAA repair, which represents better quality care.

Evidence for Rationale

National Quality Forum measure information: abdominal aortic aneurysm (AAA) repair mortality rate (IQI 11). Washington (DC): National Quality Forum (NQF); 2014 Apr 1. 13 p.

Primary Health Components

Abdominal aortic aneurysm (AAA); open or endovascular AAA repair; death

Denominator Description

Discharges, for patients ages 18 years and older, with the following:

Any-listed International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes for ruptured abdominal aortic aneurysm (AAA) and any-listed ICD-9-CM procedure code for open AAA repair; or
Any-listed ICD-9-CM diagnosis codes for unruptured AAA and any-listed ICD-9-CM procedure codes for open AAA repair; or
Any-listed ICD-9-CM diagnosis codes for ruptured AAA and any-listed ICD-9-CM procedure codes for endovascular AAA repair; or
Any-listed ICD-9-CM diagnosis codes for unruptured AAA and any-listed ICD-9-CM procedure codes for endovascular AAA repair

See the related "Denominator Inclusions/Exclusions" field.

Numerator Description

Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator

Evidence Supporting the Measure

Type of Evidence Supporting the Criterion of Quality for the Measure

One or more research studies published in a National Library of Medicine (NLM) indexed, peer-reviewed journal

Additional Information Supporting Need for the Measure

Unspecified

Extent of Measure Testing

Reliability Testing

Data/Sample. Agency for Healthcare Research and Quality (AHRQ) 2007 State Inpatient Databases (SID) with 4,000 hospitals and 30 million adult discharges.

Analytic Method. Literature summary, expert panels and empirical analysis.

Testing Results. The relatively small number of abdominal aortic aneurysm (AAA) resections performed by each hospital suggests that mortality rates at the hospital level are likely to be unreliable. Empirical evidence shows that this indicator is precise, with a raw provider level mean of 21.5% and a substantial standard deviation of 26.8% ("Healthcare Cost and Utilization Project [HCUP] Nationwide Inpatient Sample and State 88 Databases," n.d.).

Relative to other indicators, a higher percentage of the variation occurs at the provider level, rather than the discharge level. The signal ratio (i.e., the proportion of the total variation across providers that is truly related to systematic differences in provider performance rather than random variation) is low, at 30.7%, indicating that some of the observed differences in provider performance.

The signal to noise ratio is the ratio of the between hospital variance (signal) to the within hospital variance (noise). The formula is signal / (signal + noise). The ratio itself is only a diagnostic for the degree of variance in the risk-adjusted rate systematically associated with the provider. Therefore, what matters is the magnitude of the variance in the "smoothed" rate (that is, the variance in the risk-adjusted rate after the application of the univariate shrinkage estimator based on the signal ratio). What the data demonstrate is systematic variation in the provider level rate of 2.6 to 7.6 per 100 from the 5th to 95th percentile after a signal ratio of 0.307 is applied as the shrinkage estimator (that is, after accounting for variation due to random factors). An additional technique applied to the indicator is the use of multivariate signal extraction (an extension of univariate shrinkage estimator) to increase effective sample size to the extent that individual measures are correlated (Staiger et. al., 2009).

Validity Testing

Data/Sample. AHRQ 2007 SID with 4,000 hospitals and 30 million adult discharges.

Empirical evidence shows that AAA repair mortality is positively related to other post-procedural mortality measures, such as craniotomy (r=.28, p less than .0001) and coronary artery bypass graft (CABG) (r=.17, p less than .01) ("HCUP Nationwide Inpatient Sample," n.d.).

Veterans Integrated Service Networks (VISNs); and Department of Veterans Affairs (VA) versus non-VA (Nationwide Inpatient Sample) using VA inpatient data (2004 to 2007) (Pearce et al., 1999).

A survey of hospital and system leaders (presidents/chief executive officers [CEOs]) that was conducted in the first six months of 2006 with a total of 562 respondents. Hospital-level data for these composite measures were produced by applying the Inpatient Quality Indicator (IQI) to the SID of the HCUP sponsored by AHRQ. The SID includes all-payer data on inpatient stays from virtually all community hospitals in each participating state (Rutledge et al., 1996).

The developer used 100 percent national analytic files from the Centers for Medicare and Medicaid Services (CMS) for the calendar years 2003 through 2006. Medicare Provider Analysis and Review (MEDPAR) files, which contain hospital discharge abstracts for all fee-for-service acute care hospitalizations of all U.S. Medicare recipients, were used to create our main analytical datasets. The Medicare denominator file was used to assess patient vital status at 30 days. Using appropriate procedure codes from the International Classification of Diseases, version 9 (ICD-9 codes), the developer

identified all patients aged 65 to 99 undergoing elective AAA repair and pancreatectomy (Pilcher et al., 1980).

Analytic Method. Literature summary, expert panels and empirical analysis

VA- and VISN-level IQI observed rates, risk-adjusted rates, and observed to expected ratios (O/Es). The developer examined the trends in VA- and VISN-level rates using weighted linear regression, variation in VISN-level O/Es, and compared VA to non-VA trends (Pearce et al., 1999).

A t-test was used to determine the significance of differences in quality measures (Rutledge et al., 1996).

The developer first estimated risk-adjusted hospital mortality rates during 2003 to 2004. Mortality was defined as death within 30 days of operation or before hospital discharge. Patient age, gender, race, urgency of operation, median ZIP-code income, and coexisting medical conditions was adjusted for. Using logistic regression, the expected number of deaths in each hospital was estimated and then divided the observed deaths by this expected number of deaths to obtain the ratio of observed to expected mortality (O/E ratio). The developer then multiplied the O/E ratio by the average mortality rate to obtain a risk-adjusted mortality rate for each hospital. Next a hierarchical modeling techniques was used to adjust these mortality estimates for reliability. Using random effects logistic regression models, empirical Bayes predictions of mortality for each hospital were generated (Pilcher et al., 1980).

Testing Results. The correlation between hospital or physician characteristics and in-hospital mortality in most studies supports the validity of in-hospital mortality as a measure of quality (Pearce et al., 1999; Rutledge et al., 1996). Finally, excessive blood loss, which is a potentially preventable complication of surgery, has been identified as the most important predictor of mortality after elective AAA repair (Pilcher et al., 1980). Empirical evidence shows that AAA repair mortality is positively related to other post-procedural mortality measures, such as craniotomy (r=.28, p less than .0001) and CABG (r=.17, p less than .01).

Refer to the original measure documentation for additional measure testing information.

Evidence for Extent of Measure Testing

Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient Sample and State 88 Databases. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ);

Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient Sample. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ);

National Quality Forum measure information: abdominal aortic aneurysm (AAA) repair mortality rate (IQI 11). Washington (DC): National Quality Forum (NQF); 2014 Apr 1. 13 p.

Pearce WH, Parker MA, Feinglass J, Ujiki M, Manheim LM. The importance of surgeon volume and training in outcomes for vascular surgical procedures. J Vasc Surg. 1999 May;29(5):768-76; discussion 777-8. PubMed

Pilcher DB, Davis JH, Ashikaga T, Bookwalter J, Butsch DW, Chase CR, Ellman BR, Vacek PM, Lord CF. Treatment of abdominal aortic aneurysm in an entire state over 7 1/2 years. Am J Surg. 1980 Apr;139(4):487-94. PubMed

Rutledge R, Oller DW, Meyer AA, Johnson GJ Jr. A statewide, population-based time-series analysis of the outcome of ruptured abdominal aortic aneurysm. Ann Surg. 1996 May;223(5):492-502; discussion 503-5. PubMed

Staiger DO, Dimick JB, Baser O, Fan Z, Birkmeyer JD. Empirically derived composite measures of surgical performance. Med Care. 2009 Feb;47(2):226-33. PubMed

State of Use of the Measure

State of Use

Current routine use

Current Use

not defined yet

Application of the Measure in its Current Use

Measurement Setting

Hospital Inpatient

Professionals Involved in Delivery of Health Services

not defined yet

Least Aggregated Level of Services Delivery Addressed

Single Health Care Delivery or Public Health Organizations

Statement of Acceptable Minimum Sample Size

Does not apply to this measure

Target Population Age

Age greater than or equal to 18 years

Target Population Gender

Either male or female

National Strategy for Quality Improvement in Health Care

National Quality Strategy Aim

Better Care

National Quality Strategy Priority

Making Care Safer
Prevention and Treatment of Leading Causes of Mortality

Institute of Medicine (IOM) National Health Care Quality Report Categories

IOM Care Need

Getting Better

Living with Illness

IOM Domain

Effectiveness

Safety

Data Collection for the Measure

Case Finding Period

Time window can be determined by user, but is generally a calendar year.

Denominator Sampling Frame

Patients associated with provider

Denominator (Index) Event or Characteristic

Clinical Condition

Institutionalization

Patient/Individual (Consumer) Characteristic

Therapeutic Intervention

Denominator Time Window

not defined yet

Denominator Inclusions/Exclusions

Inclusions
Discharges, for patients ages 18 years and older, with the following

Any-listed International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)

diagnosis codes for ruptured abdominal aortic aneurysm (AAA) and any-listed ICD-9-CM procedure code for open AAA repair; or
Any-listed ICD-9-CM diagnosis codes for unruptured AAA and any-listed ICD-9-CM procedure codes for open AAA repair; or
Any-listed ICD-9-CM diagnosis codes for ruptured AAA and any-listed ICD-9-CM procedure codes for endovascular AAA repair; or
Any-listed ICD-9-CM diagnosis codes for unruptured AAA and any-listed ICD-9-CM procedure codes for endovascular AAA repair

Note: Refer to the original measure documentation for ICD-9-CM codes.

Exclusions
Exclude cases:

Transferring to another short-term hospital (DISP=2)
Major Diagnostic Categories (MDC) 14 (pregnancy, childbirth, and puerperium)
With missing discharge disposition (DISP=missing), gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing) or principal diagnosis (DX1=missing)

Exclusions/Exceptions

not defined yet

Numerator Inclusions/Exclusions

Inclusions
Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator

Exclusions
Unspecified

Numerator Search Strategy

Institutionalization

Data Source

Administrative clinical data

Type of Health State

Death

Instruments Used and/or Associated with the Measure

Unspecified

Computation of the Measure

Measure Specifies Disaggregation

Measure is disaggregated into categories based on different definitions of the denominator and/or numerator

Basis for Disaggregation

The indicator is stratified into four groups by 1) type of abdominal aortic aneurysm (AAA) repair (open vs. endovascular) and 2) AAA rupture status.

Cases are assigned to strata according to a hierarchy based on mortality, with cases being assigned to the stratum with the highest mortality for which the case qualifies. In the case of AAA Repair Mortality, the current hierarchy is as follows:

Strata hierarchy (listed from highest mortality to lowest mortality):

Stratum A (Open repair of ruptured AAA)
Stratum C (Endovascular repair of ruptured AAA)
Stratum B (Open repair of unruptured AAA)
Stratum D (Endovascular repair of unruptured AAA)

Numerator

Stratum A (Open repair of ruptured AAA): Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator.
Stratum B (Open repair of unruptured AAA): Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator.
Stratum C (Endovascular repair of ruptured AAA): Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator.
Stratum D (Endovascular repair of unruptured AAA): Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator.

Denominator

Stratum A (Open repair of ruptured AAA): Discharges, for patients ages 18 years and older, with any-listed International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis code for ruptured AAA and any-listed ICD-9-CM procedure code for open AAA repair.
Stratum B (Open repair of unruptured AAA): Discharges, for patients ages 18 years and older, with any-listed ICD-9-CM diagnosis code for unruptured AAA and any-listed ICD-9-CM procedure code for open AAA repair.
Stratum C (Endovascular repair of ruptured AAA): Discharges, for patients ages 18 years and older, with any-listed ICD-9-CM diagnosis code for ruptured AAA and any-listed ICD-9-CM procedure code for endovascular AAA repair.
Stratum D (Endovascular repair of unruptured AAA): Discharges, for patients ages 18 years and older, with any-listed ICD-9-CM diagnosis code for unruptured AAA and any-listed ICD-9-CM procedure code for endovascular AAA repair.

Scoring

Rate/Proportion

Interpretation of Score

Desired value is a lower score

Allowance for Patient or Population Factors

not defined yet

Description of Allowance for Patient or Population Factors

The predicted value for each case is computed using a hierarchical model (logistic regression with hospital random effect) and covariates for gender, age in years (in 5-year age groups), All Patient Refined-Diagnosis Related Group (APR-DRG) and APR-DRG risk of-mortality subclass. The reference population used in the model is the universe of discharges for states that participate in the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID) for the year 2008 (updated annually), a database consisting of 43 states and approximately 30 million adult discharges and 4,000 hospitals. The expected rate is computed as the sum of the predicted value for each case divided by the number of cases for the unit of analysis of interest (i.e., hospital). The risk adjusted rate is computed using indirect standardization as the observed rate divided by the expected rate, multiplied by the reference population rate.

Refer to the original measure documentation for the risk adjustment factors.

Standard of Comparison

not defined yet

Identifying Information

Original Title

IQI 11: abdominal aortic aneurysm (AAA) repair mortality rate.

Measure Collection Name

Agency for Healthcare Research and Quality (AHRQ) Quality Indicators

Measure Set Name

Inpatient Quality Indicators

Submitter

Agency for Healthcare Research and Quality - Federal Government Agency [U.S.]

Developer

Agency for Healthcare Research and Quality - Federal Government Agency [U.S.]

Funding Source(s)

Agency for Healthcare Research and Quality (AHRQ)

Composition of the Group that Developed the Measure

The Agency for Healthcare Research and Quality (AHRQ) Quality Indicator (QI) measures are developed by a team of clinical and measurement experts in collaboration with AHRQ. The AHRQ QIs are continually updated as a result of new research evidence and validation efforts, user feedback, guidance from the National Quality Forum (NQF), and general advances in the science of quality measurement.

Financial Disclosures/Other Potential Conflicts of Interest

None

Endorser

National Quality Forum - None

NQF Number

not defined yet

Date of Endorsement

2015 Jan 5

Adaptation

This measure was not adapted from another source.

Date of Most Current Version in NQMC

2015 Mar

Measure Maintenance

Measure is reviewed and updated on a yearly basis

Date of Next Anticipated Revision

Spring 2016 (version 6.0, including International Classification of Diseases, Tenth Revision, Clinical Modification [ICD-10-CM] and International Classification of Diseases, Tenth Revision, Procedure Coding System [ICD-10-PCS] compatible software)

Measure Status

This is the current release of the measure.

This measure updates a previous version: AHRQ QI. Inpatient quality indicators #11: technical specifications. Abdominal aortic artery (AAA) repair mortality rate [version 4.4]. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2012 Mar. 1 p.

Measure Availability

Source available from the Agency for Healthcare Research and Quality (AHRQ) Quality Indicators (QI) Web site.

For more information, contact the AHRQ QI Support Team at E-mail: QIsupport@ahrq.hhs.gov; Phone: 301-427-1949.

Companion Documents

The following are available:

AHRQ quality indicators. Inpatient quality indicators (IQI) parameter estimates [version 5.0]. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2015 Mar. 42 p. This document is available from the AHRQ Quality Indicators Web site.

AHRQ quality indicators. Inpatient quality indicators benchmark data tables [version 5.0]. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2015 Mar. 22 p. This document is available from the AHRQ Quality Indicators Web site.

AHRQ quality indicators. Inpatient quality indicators composite measure workgroup. Final report. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2008 Mar. various p. This document is available from the AHRQ Quality Indicators Web site.

HCUPnet: a tool for identifying, tracking, and analyzing national hospital statistics. [Web site]. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); [accessed 2015 Sep 10]. HCUPnet is available from the AHRQ Web site.

NQMC Status

This NQMC summary was completed by ECRI on December 4, 2002. The information was verified by the Agency for Healthcare Research and Quality on December 26, 2002.

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Copyright Statement

Production

Source(s)

AHRQ QI research version 5.0. Inpatient quality indicator 11 technical specifications: abdominal aortic aneurysm (AAA) repair mortality rate. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2015 Mar. 3 p.

National Quality Forum measure information: abdominal aortic aneurysm (AAA) repair mortality rate (IQI 11). Washington (DC): National Quality Forum (NQF); 2014 Apr 1. 13 p.

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